

SHIFTING FOOD SYSTEMS: INCREASING WELL-BEING THROUGH PLANT-BASED APPROACHES

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Growing evidence reveals food production systems and consumption practices contradict goals for environmental well-being and population health. This interdisciplinary paper reviews research for impacts from diets on non-communicable human diseases, climate change, and animal well-being. With increasing pressures to innovate and reduce economic as well as emotional costs associated with ill-health, our recommendations could positively impact policy.

Keywords: Well-being, Preventative health, Environmental sustainability, Ethical food, Food systems, Plant-based diets

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1. INTRODUCTION

This interdisciplinary, critical assessment examines alternative approaches to replace adverse outcomes arising from diets high in fat, salt, sugar, and processed foods including meat and dairy. This hypothesis paper includes a study of ways to prevent or mitigate risks to public health, environmental stability, or animal well-being. Increasing global warming, greenhouse gas emissions, and climate change are closely connected with dietary choices¹. “Civilisation as we know it can’t withstand the stresses of continuing with business as usual”². Shifts in food production and consumption are required to bring out needed adjustments to climate-change while also ensuring more people are sustainably nourished. Jean-Jacques Rousseau, in *The Social Contract*³ argues that we mature as human beings, where we are not simply driven by our appetites and desires but where and when we become conscious, self-governing, self-disciplined beings. Contradictions arising in contemporary agricultural and food systems necessitate examining such things as values, policies, practices and assumptions about human health, food, and social and generational equity. As a growing number of scholars contend, meat based diets are contributing substantially to global emissions and water and energy consumption.^{4,5} Consequently, maintaining the status quo could be deemed as irresponsible and unconscionable. We hypothesize that shifts in food systems policies and practices that support citizens choosing whole-food, plant-based diets may promote beneficial outcomes for health, climate, and equity.

2. METHODS

This review of interdisciplinary research uses an *appreciative inquiry*⁶ approach along with *critical theory*. “Appreciative inquiry proposes reawakening collaborative action research so that it is grounded on a deep kind of participative, intuitive and appreciative way of knowing”.⁷ Critical theory employs a social-constructivist perspective that proposes that human inactions, actions and interactions arise out of intersecting, complex, and often contradictory beliefs and practices.^{8,9} Critical theory posits that our interpretations of reality are social constructions and these constructed perspectives heavily influence, and are influenced by, socio-cultural and political contexts.⁸ In society certain ideas dominate and become accepted and these ideologies often serve the interests of those with influence. “People learn to embrace as commonsense wisdom, certain beliefs, and political conditions that work against their interests and serve those of the powerful”.⁸ Critical theory can be used to identify patterns and opportunities to better society though progressive and transformational change.¹⁰

A research team was constituted to include specialists from the fields of medical sciences, social psychology, agricultural business and animal well-being. This team applied collaborative and intuitive action research. Search terms used in this search included: healthy diet, population health, trends in food, nutrition and health integration, food and environment, animal rights, agriculture and food production and consumption, food systems and consumer well-being.

3. FINDINGS AND RESULTS

Findings are distilled into the following themes: agriculture and economics; environmental impact of human production and consumption practices; dispassion and disconnection from food, animals and the environment; human health impacts from animal consumption; whole-food, plant-based diets; and social change and diet transitions - policy and systems changes.

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3.1. Agriculture and economics

Transitions in agriculture, from pre-industrial to highly mechanized models, and from local and regional to more globalized trade have been widely researched and documented.^{9,11–14} Economic arguments for producing the maximum yield per hectare at the lowest cost per unit have been well mounted. Agriculture has been transformed—from agri-culture to agri-business.^{15,16} Farm size has been increasing while farm numbers have been significantly decreasing. For example, in 2007, Canada had 11,000 hog farming operations but by 2011 this number had contracted to approximately 7000 larger production facilities.¹⁶ In the U.S. the numbers of hog farms dropped by 70% over 1991–2009 although the inventory of hogs remained stable, contributing to an industry with fewer yet larger hog enterprises.¹⁷ Such models offer benefits from a business perspective. The health and well-being impacts are less frequently calculated. Pressures to enlarge farms have forced many off the farm and contributed to declines in rural populations. Within a generation or two, many have lost their connections to agriculture and increasingly to understanding impacts of production and consumption of food. With urbanization as a global phenomenon, such disassociations are likely to continue, unless effectively recognized and addressed.¹⁵

In the USA, what farmers grow, what foods are available, who will profit, and the availability of food-stuff are influenced by the US Farm Bill.^{1,18} The Farm Bill was initially created to help increase and secure farm revenues, to ensure a steady food supply, and support the American farm economy.¹⁸ With governmental support disproportionately bestowed on barley, corn, soy, rice and wheat, these subsidies significantly reduce costs for processed foods and farm animal feed. Subsidies make it feasible for producers and processors to add fats, sugars, and oils at lower-costs thus making fast-food cheap, accessible and government supported. Yet these same subsidies feed into diets and food systems that are damaging the health of, and the environment for, North Americans.¹⁸ Can it be rationalized that the US Farm Bill supports food systems that damage health, environment, and national security?^{18,19} Governments, food manufacturers, and retailers increasingly determine what farmers grow by placing strict requirements in contractual agreements. Over time profits have increased for those food producers best positioned to purchase in great volume and to process and distribute widely.¹⁵ This economic model has not been as favorable for smaller farming operations or the more traditional ‘family farm’. Consequently, farmers operate within a ‘largely undeclared continental food regime sometimes called “the cheap food policy” that enables North Americans to pay disproportionately little for their food’.¹⁶ Research shows that the price of fresh fruit and vegetables has increased 118% from 1985 to 2000, whereas the price of fats and oils has increased only 35%.^{18,20} If, *in practice*, agricultural policy also becomes economic policy, environmental policy, social policy and health policy, would it be considered *good policy* after critical analyses?

3.2. Environmental impact of human production and consumption practices

The scientific community largely agrees that anthropogenic practices are significant drivers of climate change (CC).²¹ Researchers have identified a multitude of actions required to reduce CC, food insecurity, and water contamination and land quality

degradation. The adverse impacts of CC are not uniform. The future consequences of anthropogenic CC are predicted to be disproportionately carried by the world’s most vulnerable populations^{22,23} and bodies like the Intergovernmental Panel on Climate Change are urging industries, communities, households to recognize and refrain from practices that exacerbate CC and increase GHG emissions. What follows is the elucidation of practices most associated with reducing CC and increasing individual and environmental health and well-being.

3.2.1. Environmental implications of meat production

Livestock production and consumption are burgeoning in many parts of the world. Enterprises engaged in livestock production are positioning themselves to capitalize on human population growth, urbanization, and growing global incomes. Between the years of 1961 and 2001, the production of dairy increased by 70% while meat production increased more significantly by 245%.²⁴ American livestock consumes seven times as much grain as is consumed directly by the population, and the amount that they do consume is sufficient to feed about 840 million people.⁵ Livestock production consumes 10 times as much land as crop production to create the same amount of food.²⁵ As meat consumption continues to be normalized, greater swaths of land, water, energy and natural resources are slated for use. While the environmental impact varies according to meat production practices, members of the livestock sector acknowledge that this “sector has a severe environmental impact on air, water and soil”.²⁶ Approximately 70% of water pollution in lakes and rivers within the United States is caused by pollution from animal farms²⁷ and the pressure to increase productivity exacerbates several biophysical problems through resource-intensive inputs contributing persistent toxins along with GHG emissions.^{5,28} While figures vary and data are hard to accurately compare, much agreement can be found that livestock production is a significant contributor to anthropocentric greenhouse gas emissions. Nestle reports that emissions from the chain of livestock production and consumption are equivalent to, or greater than, all forms of transport.²⁹ Studies by FAO³⁰ return findings from global livestock production: 7.1 Gigatonnes of Co2-equiv per year, representing 14.5% of all anthropogenic GHG emissions. Cattle, raised largely for both beef and milk, are the animal species with the greatest emissions, representing about 65% of the livestock sector’s emissions. Yet emissions arise through all forms of animal feed production and processing, enteric fermentation from ruminants, manure storage and processing as well as the processing, storage and transportation of animal products.^{18,30} As well, the 20% of American beef cattle raised on grass also contribute to GHG and their overgrazing is linked to other adverse effects on wildlife populations.²⁵ The global population is projected to increase along with an increase in per capita real income. Based on current patterns, the need for grain is expected to double along with the demand for animal products.³¹

Yet with this growing body of evidence revealing the adverse environmental impacts from animal agriculture, some countries are recognizing “the long shadow of livestock” and are mandating significant reductions. China, for example, has pronounced a move to 50% reduction in meat production and consumption

over 15 years.^{32,33} Some leaders in the Netherlands argue for reduction of dairy and meat to achieve goals of reducing GHGs and their associated costs.³⁴ Even 25% reduction in meat production and consumption would move countries closer to meeting their UN GHG targets.^{35,36} Increasing meat and dairy production, with their unprecedented contributions to GHG emissions, have been found to be unsustainable^{20,37} and unfavorable for planetary and human well-being.^{28,38} Some researchers, like Deckers, argue that animal consumption should only be supported where not doing so would produce unacceptably large negative personal, social, or ecological impacts.³⁹

3.2.2. *Dispassion and disconnection from food, animals and the environment*

Food connects humans in practical and intimate ways with the earth. What humans choose to consume as food stimulates physical and emotional consequences.⁴⁰ Researchers argue there is a growing disconnection between food consumption and production and a rising sense of dispassion and alienation from the value of food, animals⁴¹, and the environment.^{36,42} Baur argues that rational humans have become *rationalizing humans*, ready to disregard science, morals, and their own well-being as humans rationalize slaughter and consumption of animals.^{38,43} Joy introduces the notion of “carnism,” the invisible belief system and ideology that conditions people to eat certain animals and not others, while viewing meat eating as normal, natural and necessary, rather than as a choice.⁴¹ Yet most people demonstrate empathy and become disturbed by the suffering of people and of animals but they may be less able or willing to take suitable action.⁴⁴ Humans have demonstrated the capacity to justify exploitive relationships with animals or other people. People who practice abuse also nullify their victims’ feelings and individuality, which in some cases leads to acts of sadistic cruelty. Mistreatment of animals has been linked to violence against humans. Workers in slaughterhouses have been found to disproportionately demonstrate less empathy, and a greater propensity for cruelty and violence.⁴¹ This process of desensitization appears to be an adaptive practice to maintain the ability to dispassionately kill animals in a daily, routine manner.

3.3. Human health impacts from animal consumption

An extensive body of literature argues for the need to reduce meat consumption. The rise in consumption of high calorie, low nutrition foods⁴⁵ and the normalization of daily meat and dairy use, are contributing substantially to burgeoning costs for illness-care. Dodge, the former Governor of the *Bank of Canada* along with his colleague Dion, report that by 2030, Canadian provincial health care expenditures will account for about 80% of provincial program spending.⁴⁶ Escalating costs are driven mostly by an increase in the use of drugs, medical technology and human resources to treat a growing burden of largely *preventable, chronic, non-communicable diseases* (NCD), of which the four main types are cardiovascular disease, diabetes, cancer, and chronic respiratory disease.

Growing levels of illnesses worldwide also mean escalating economic burdens across the globe.⁴⁷ NCD account for more than two-thirds of deaths worldwide.⁴⁸ American healthcare

costs from NCD could be reduced by 70% through preventative diet and lifestyle.⁴⁹ While efforts are invested in maintaining the standard American diet and leaving food systems intact, inordinate amounts of time, money, and resources are spent on painful interventions to reclaim deteriorating health.^{46,50} American healthcare spending totaled \$3.0 trillion USD, or 17.5% of the Gross Domestic Product (GDP), in 2014 and is projected to rise to 20.1% of GDP in 2025.⁵¹ A 2013 report from the Organization for Economic Cooperation and Development (OECD) indicates that health care spending in OECD countries is about 6% of GDP. This spending is projected to reach 9.5% or 14% of GDP by 2060, depending on the calculated scenario.⁵²

Among chronic diseases, cardiovascular disease is the leading cause of death worldwide (examples of which include coronary artery disease, heart attack, stroke, and peripheral artery disease).⁵³ The number of people dying from cardiovascular disease increased from 12.3 million in 1990 to 17.3 million in 2013.⁵⁴ It is sobering to recognize that 90% of coronary heart disease is preventable.⁵⁵ Obesity and diabetes, which are important risk factors for cardiovascular disease, also are increasing at epidemic proportions globally.^{56,57} Dietary and lifestyle changes can have significant impact on these global health challenges.

While cardiovascular mortality rates had been on the decline up to 2011, Sidney et al. found, alarmingly, that this decline has slowed significantly since 2011.⁵⁸ Using data from the Centers for Disease Control and Prevention, they reported a drop in the annual rate of decline for cardiovascular from 3.79% (95% CI, 3.61–3.97%) for 2000–2011 to 0.65% (95% CI, –0.18–1.47%) for 2011–2014, to the point of near stagnation. These data suggest that benefits in cardiovascular outcomes from medical interventions have reached a plateau and that, to turn the tide in this stagnation, changes in behavior and lifestyle choices are needed. The authors called on “expanded innovative efforts to improve population-level CVD prevention.” Commenting on these results, Lloyd-Jones admonished, “Until we are serious about primordial prevention, beginning in utero and lasting through early childhood well into middle age, we will continue to require more medical interventions, and incur more costs, to curb CVD”.⁵⁹

3.4. Whole-food, plant-based diets

A growing body of epidemiological and clinical studies suggests whole-food, plant-based diets may help to prevent chronic diseases,^{20,60} modify cancer progression,^{50,61} or reverse significant coronary artery blockage, as documented through coronary angiography.^{50,61,62} Plant-based diets are associated with lower risks of cardiovascular disease,⁶³ diabetes,⁶⁴ cancer,^{65,66} and premature deaths,^{67,68} along with reduced risks of stroke, cognitive impairment, and depression.⁶⁹ Orlich et al in a prospective cohort study examining 73,308 participants from the Adventist Health Study 2, found that lacto-ovo vegetarians and vegans have lower all-cause mortality risks of 9% and 15%, respectively, compared with non-vegetarians.⁶⁷ Using data from the Nurses’ Health Study and Health Professionals Follow-up Study in a multivariable model, Song et al. found that replacing animal protein of various origins in the diet with plant protein is associated with lower mortality. For example, replacing 3% of energy with plant protein for an equivalent amount of protein from

processed red meat lowers the mortality risk by 34%, unprocessed red meat by 12%, and egg by 19%.⁷⁰

Using a comparative risk assessment model, Springmann et al found that the adoption of a vegetarian diet (including eggs and dairy) would result in 7.3 million avoided deaths (95% CI, 7.0–7.6 million) and 114 million life years saved (95% CI, 111–118 million) for the year 2050, and that the adoption of a completely plant-based (vegan) diet would result in 8.1 million avoided deaths (95% CI, 7.8–8.5 million) and 129 million life years saved (95% CI, 125–133 million).⁶⁸ About 45–47% of all avoided deaths were from reduced coronary heart disease, 26% from stroke, 16–18% from cancer, and 10–12% from type 2 diabetes mellitus. While the greatest number of avoided deaths would occur in developing countries, viewed from the perspective of avoided deaths per capita, the greatest benefits of dietary change would occur in developed countries due to the relatively larger per capita reductions in red meat consumption and total energy intake.

Ornish et al⁵⁰ showed that a program of comprehensive lifestyle changes that included a 10% fat vegetarian diet reduced the risk of an adverse cardiac event by almost 2.5 fold. In a study of 198 participants with cardiovascular disease counseled on plant-based nutrition, Esselstyn et al⁶² reported a lower incidence of major cardiac event rate (1 out of 177, 0.6%) in individuals judged to be adherent to a plant-based diet (defined as elimination of dairy, fish, and meat, and added oil) than those who were non-adherent to the diet (13 out of 22, 62%). Similar commitments to lifestyle changes, including a vegan diet, were found to affect the progression of early, low-grade prostate cancer in men⁶¹ and modify prostate gene expression and telomere length in men with prostate cancer.^{50,61} A large epidemiologic study, the China Project, published by Campbell and Campbell⁶⁰ showed that individuals who consumed a diet closest to a whole-food, plant-based diet had the lowest risk of having chronic diseases including cardiovascular disease and cancer.⁷¹

In a pooled analysis of almost 5000 incident cancer cases using data from the EPIC-Oxford and Oxford Vegetarian studies, Key et al found that vegetarians and vegans have significantly lower risks of cancer incidence compared with meat eaters (11% and 19% lower risks, respectively; 95% CIs, 4–17% and 2–34%).⁶⁵ Orlich et al⁶⁶ reported a lower risk of developing colorectal cancer in vegetarians compared with non-vegetarians (22% lower risk; 95% CI, 5–36%) in the Adventist Health Study 2.

While benefits of diets rich in vegetables and fruits have been well-documented, many adults and children are found to not consume the recommended amounts. Lin and Morrison reported that lower fruit or vegetable consumption among men and women was associated with higher body weight.⁷² Other studies show that higher vegetable intake can be associated with a decrease in BMI and waist circumference in adults.⁷³ As well, the amount of protein many consume was much higher than recommended. The daily requirement for protein is 56 grams, whereas the average American meat-eater consumes 222 grams a day.⁵

3.4.1. Shifting to plant-based diets

With increased health education efforts emphasizing plant-based diets and decreasing consumption of animal

products, there has been considerable advancement in the number of Americans who became vegan from 300,000 to 500,000 in 1997 to between 2.5–6 million in 2012,⁷⁴ and in a 2016 poll commissioned by the Vegetarian Resource Group, 3.7 million US consumers claimed to be vegan (Harris Poll, 2016).^{RW.ERROR}

- Unable to find reference:doc:5abe791ce4b0770b05a429e2 The practice of veganism is becoming more popular in the world as consumers express more concern for their health, illness-costs, animal welfare, and the environment.^{39,75} A meta-analysis indicated that such a dietary pattern also is associated with a lower risk of depression.⁷⁶ Studies of vegan diets propose they can help curtail climate change by releasing approximately half of the GHG compared to an average diet.³⁷ The global adoption of vegetarian diets could result in food-related GHG emissions in 2050 that would be 45–55% lower than 2005/2007 levels and 63–70% lower than a no-dietary-change scenario.^{35,68} In contrast, food-related GHG would increase by 51% from 2005/2007 to 2050 if no dietary changes are made.⁶⁸

The growing practice of switching from the widely accepted omnivore diet to a vegan diet also may foster positive economic results. Using a conservative cost-of-illness approach, Springmann and colleagues estimated the health-related cost savings in 2050 of adopting vegetarian and vegan diets to be \$973 billion USD (range \$644–1303 billion) per year and \$1,067 billion (range \$708–1426 billion) per year, respectively.⁶⁸ As a percentage of expected world gross domestic product (GDP), these savings amount to 3.0% (2.0–4.0%) for vegetarian diets and 3.3% (2.2–4.4%) for vegan diets. The economic benefits of reduced GHG emissions were estimated to be \$511 billion per year for vegetarian diets and \$570 billion per year for vegan diets.^{35,68} Economic opportunities are emerging with creative use of pulses, beans, nuts and seeds, and other plant foods. One such initiative is Verdient Foods, where James Cameron, the famed film director, is investing in the world's largest pea protein production. *PlantPure Nation, Farm to Cafeteria Canada* and *Healthy Food in Health Care* are examples of civil society and public health interventions to inspire citizens to transition to plant-based diets. The benefits from plant-based initiatives through businesses and community efforts are expected to substantially increase local economies while significantly decreasing health care related costs.^{35,77}

Based on the evidence, adopting “cleaner and greener” diets are proving to be beneficial from environmental, ethical, health, and economic perspectives. Thus strategies to address entrenched impediments may become valuable to reorient citizen-consumers to diets found to be healthier, more sustainable and compassionate. “Who should act: the state, individuals, commercial interests, or social movements?”⁷⁸ Leaders in all sectors play significant roles in igniting public imagination, arousing public support and pursuing healthy transitions.⁷⁹ Governments particularly are called upon to invest in preventative approaches. Even when presented with sound science and analyses, governments have been impeded by the food industry from adequately addressing “climate change, water stress, energy pressures, demographic change, the nutrition transition, and a host of societal and environmental considerations”.⁷⁸ As Tolkien, the famous professor and fantasy writer, wisely postulated, “It does no good to leave a dragon out of your calculations if you live near one”.⁸⁰

Parallels may be found with similarly powerful groups, like Big Tobacco. Active observers would concede that a 100-year ‘war’ has been underway where the rights and power of tobacco companies have trumped the rights of citizens to health and information.⁸¹ In a review by Brownell and Warner of decades of industrial tobacco practices, Judge Sarokin sums up the insidious practices of tobacco companies, “All too often in the choice between the physical health of consumers and the financial well-being of business, concealment is chosen over disclosure, sales over safety, and money over morality”.⁸² “When we launched our investigation of tobacco at the Food and Drug Administration, we had no idea of the power wielded by the tobacco companies. But, [as Kessler states], we soon learned why the tobacco industry has for decades been considered untouchable”.⁸²

4. RECOMMENDATIONS AND CONCLUSIONS

4.1. Appreciative approach and critical analyses

The arising consequences from entrenched food systems and power structures are ignored at human peril. Our critical analyses expose intersecting, complex, and often contradictory beliefs and practices operating in food systems and dietary practices. The integrated, appreciative approach reveals multiple gains through plant-based diets and lifestyles. Transitions have become imperative. Diets are social constructions, informed by science but heavily influenced by socio-cultural, political and geographical contexts. By using appreciative and critical theory in this paper, we identify patterns and opportunities for progressive and transformational shifts in beliefs, policies, diet and lifestyles.¹⁰

4.2. Limitations and future research

More attention is needed to reveal strategies that can concurrently meet economic, health, ecological, and moral standards. Also targeted research could help examine campaigns designed to protect environmental assets and reorient to sustainable production and consumption practices. Campaigns using coalition building, education, multi-media, and direct action could be explored for their efficacy in disrupting and displacing the current beliefs and practices.

4.3. Social change and diet transitions - policy and systems changes

Governments are called upon to support conditions to improve nutritional quality of food, prevent ill health and environmental contamination and address gaps in the fields of agriculture, food, and well-being. Governments have available various mechanisms to orchestrate desired outcomes like using taxes, incentives, regulation and education to facilitate results. Agriculture policy, like environmental policy, is of such broad importance and influence that it requires “that those concerned about health and well-being become involved in this issue...”.⁸³ Improvements in food systems and dietary choices necessitate consideration of the impacts arising from policies and practices in agriculture, transportation, education, employment, zoning, and trade liberalization⁸⁴ and physical health of consumers and the financial well-being of businesses. Governments are obliged to ensure industry operates in a climate of disclosure being the

default over concealment, safety over sales and morality over money.⁸² What if the governments structured agricultural subsidies and programs to support agricultural prosperity that also advanced public health, improved access to healthy food while supporting small farm viability and rural well-being?³⁷ Lang, a leading food system strategist, recommends policies that consider food—health—environment.⁸⁵ Just as governments mandates include establishing infrastructure to support profitable businesses, they also must foster conditions to make public health achievable. One example is subsidizing public assistance recipients to purchase fruits and vegetables at farmers’ markets or offering social prescriptions that provide needed physical and social activities. Such types of policies are gaining significant traction.^{86–88} The compelling evidence presented here reveals the imperative for shifts in lifestyle, public health, and sustainable food consumption. Given the issues are economic, ethical, environmental, social and health, among others, solutions that facilitate policy coherence are needed.^{85,89}

Engaging multi-stakeholders in community-derived models of community, economic, and agricultural development have been recommended by Lyson and Guptill in their work on *civic agriculture*⁹⁰ and collaborative approaches are echoed in several other works.^{85,89,91,92} Success in forging transitions in food systems become more viable through building a coalition of influential actors, like health professionals, governments, leaders in agriculture and environment along with health and environmentally conscious champions in industry. Enabling consumer engagement would also be valuable.⁸⁴ Joint efforts have proven fruitful in designing actions to mitigate climate change⁹³ and in devising safer and less polluting vehicles.⁹⁴ Such strategic transformations would build in approaches to evaluating change and transparent accounting that “include non-industry-determined benchmarks for success and an objective evaluation of their impact”.⁸² Clearly there are a range of concerns to be addressed from ethical distribution of food, environmental protection and the dreams of channeling funds away from illness to afford an abundance of resources invested in health prevention. Transformed food systems could be monitored through a “regional food system report card”,⁸³ among other approaches.

For their part, the role of citizens also are crucial. A growing cohort of critical and conscientious consumers are voting with their dollars and identifying business leaders and products that support nutritious, affordable, convenient, sustainable and safe food and beverages. More citizen-consumers are coalescing against the commodification, confinement and curtailing of the lives of animals by the meat industry. They are demanding civil and sanitary treatment as well as urging shifts away from using animals for food. The callous desensitization involved in the killing and eating of animals undermines advances in human expression of compassion.⁸⁷ Critical citizens too are not willing to acquiesce and indirectly further fuel the environmental destruction that could be prevented, so they are choosing to integrate plant-based living. More citizens could become cognizant of and come to appreciate the deep cognitive and emotional complexity of animals.^{41,43} With increasing numbers of citizens joining environmental and animal rights movements, they are becoming advocates of plant-based lifestyles focused on improving psychological, emotional, and physical well-being of all living beings.

As we have argued, agricultural policy *is* economic policy, environmental policy, social policy and health policy. But the questions persist, will these constitute healthy, sustainable and justifiable policies for all? Policies should integrate the latest science and proven approaches to contribute to producing desired results while preventing harmful impacts. If current food systems and beliefs are left intact inordinate amounts of tax dollars, public and private resources and emotional toil will continue to be spent on intrusive efforts to reclaim deteriorating health. For coherence to be achieved citizen advocates, government policy makers and business leaders must calculate the social, economic, and political implications as much as scientific and technological ones.⁹⁵ “Living successfully in a world of systems requires more of us than our ability to calculate. It requires our full humanity—our rationality, our ability to sort out truth from falsehood, our intuition, our compassion, our vision, and our morality.”⁹⁶ To reorient systems to produce sought after ethical, environmental, economic, health and social outcomes, systems thinking and collaborative strategies are required. These urgent issues demand greater transparency, food literacy and government accountability. Building trust and confidence among citizens, industry, government and civil society are foundational to forging functioning systems. Facilitating cultures of distributed learning^{97,98} may serve to illuminate the consequences arising from the established systems and help to cultivate the attitudes, knowledge and skills that food literate societies ought to demonstrate.⁹⁹ This urgent state calls for leadership and action. Leaders in health care, agriculture, business, education, environment, ethics, and community are well positioned to recommend eating less meat and more equitable distribution of food through plant-based diets and lifestyles.^{100, 101} Businesses can disrupt former practices and focus less on concealment by expanding their products and channeling resources to address the growing appetite in plant-based food options and lifestyles. The prudence of such policies, practices and lifestyles is evident in the improvements to environmental and human health while reducing suffering for all.

No competing interests to declare.

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SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.explore.2018.04.012](https://doi.org/10.1016/j.explore.2018.04.012).

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